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GB 2118739 A EP 0544135 A WO 97/14512 A

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(54) Adjusting means for a movable member

(57) The device for moving a member such as a tilt and slide sunroof 11 comprises a drive means 10, a displacement encoder 15 and at least two absolute position transmitters 16, 17, each of which gives a signal in either of two switching states, and means 27 for determining the position of the movable member from the outputs of all the transmitters, and preferably also from the direction of rotation of the motor. The absolute position encoders may be cams 22, 23, 31, 32 and switches 25, 33. As described, one of the absolute position transducers defines a position adjacent the closed position of the sunroof, and the other defines the open position(s). After settings have been lost, an initial, safe, direction of the motor can be determined from the outputs of the absolute position sensors, and subsequent movement will produce further position signals from which the position determined by the displacement encoder output can be referenced.

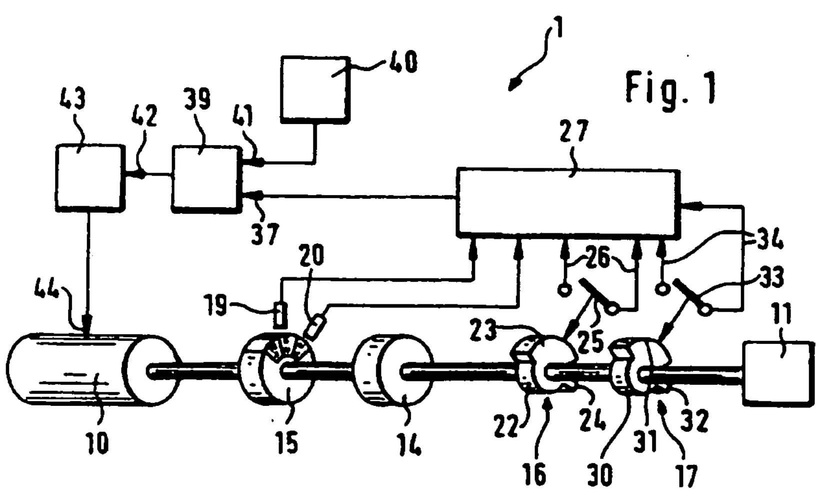

Fig. 1

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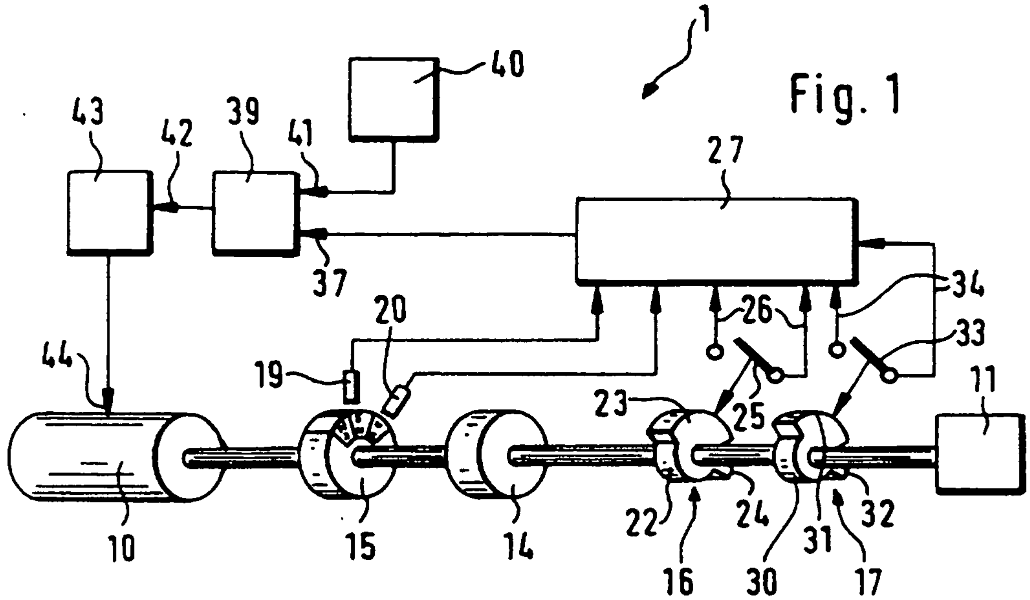
1
40
43
42
39
41
27
37
34
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26
44
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33
23
25
11
10
15
14
22
24
31
32
16
30
17

Fig. 1

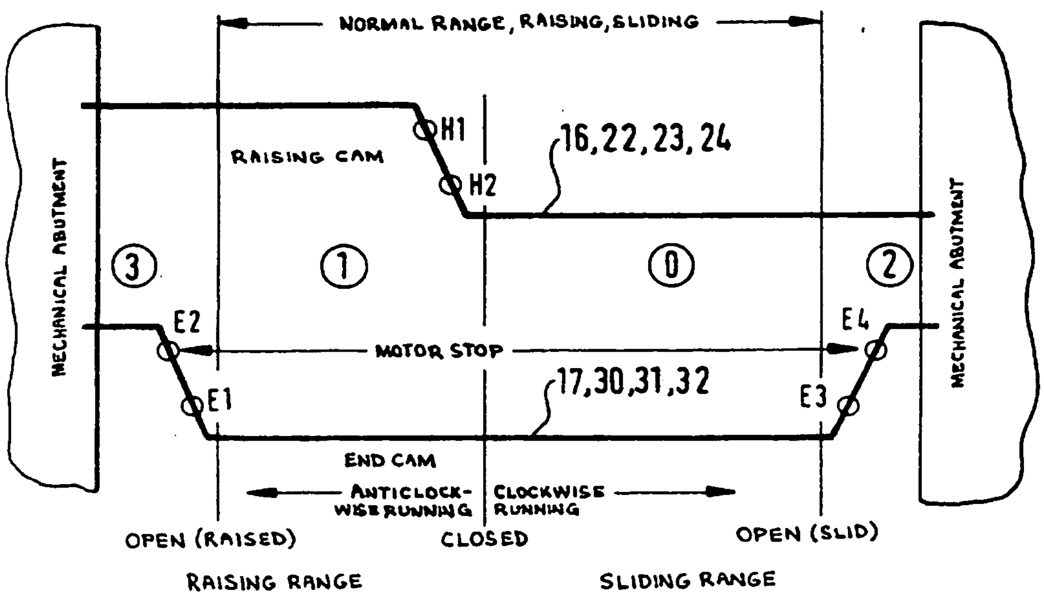
NORMAL RANGE, RAISING, SLIDING
H1
RAISING CAM
H2
16,22,23,24
MECHANICAL ABUTMENT
3
1
0
2
MECHANICAL ABUTMENT
E2
MOTOR STOP
E4
E1
17,30,31,32
E3
END CAM
ANTICLOCKWISE RUNNING
CLOCKWISE RUNNING
OPEN (RAISED)
CLOSED
OPEN (SLID)
RAISING RANGE
SLIDING RANGE

Fig. 2

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ADJUSTING MEANS FOR A MOVABLE MEMBER

The present invention relates to adjusting means for a movable member, especially a movable roof panel of a motor vehicle.

In DE-OS 42 29 439 there is disclosed adjusting means comprising an electric motor for driving a sliding-raising roof, the position of which is to be regulated precisely. The position of the roof is detected by an incremental position transmitter and a single absolute value position transmitter. The absolute value position transmitter has the form of a microswitch which is actuable by way of a cam wheel. The cam wheel distinguishes four positions of the roof, wherein merely two switching flanks can be evaluated by direct movement against the same. In the case of a sliding-raising roof, basically three end settings are provided, namely a zero setting with the roof closed, an end setting in pivoted or raised position and an end setting in slid position. The exact ascertaining of position of the roof is carried out by evaluation of the electrical signals of the absolute value position transmitter and by evaluation of the electrical signals of the incremental transmitter. In certain circumstances, for example current failure or adjustment of the roof by hand, the position ascertained from the transmitter signals does not correspond with the actual position of the roof. It is thus no longer recognisable in which position the roof is disposed, which can lead to a false reaction of the roof drive or even to failure of the roof drive. The known adjusting means with a single absolute value position transmitter is therefore statically not stable due to ambiguities of the switching signal delivered by that transmitter. Moreover, it is necessary in the known adjusting means to store the adjusting movement of the roof in a microcontroller that is provided. A voltage failure, however, means that the system no longer has any information about the actual position of the roof and in some circumstances identifies a false position, so that a false system reaction or an undesired positional change of the roof takes place.

According to the present invention there is provided adjusting means for a movable member, such as a sliding-raising roof of a motor vehicle, which comprises an electrical drive, an incremental position transmitter and an absolute value position transmitter, wherein an ascertaining unit ascertains the position of the member driven by the electrical drive, characterised in that two absolute value position transmitters are provided, each of which can assume two switching states for delivery of corresponding electrical signals to the ascertaining unit.

Preferably, the position of the movable member is determinable in dependence on the direction of rotation of the drive from the switching changes of the two absolute value position transmitters. For preference, each absolute value position transmitter comprises at least two cams which co-operate correspondingly with switching means, for example microswitches. Expediently, the switching flank delivered by a second one of the position transmitters can be detected for the closing of the movable part. The ascertaining unit can be, for example, a microcontroller.

Adjusting means embodying the invention may have the advantage that an unambiguous recognition of position and thereby positioning of the movable member is possible at any time. It is particularly advantageous that a possible voltage failure or system crash of a microcontroller, when used, has no disadvantageous consequences. Thus, otherwise required special functions of a program, which runs in the microcontroller and would have to react immediately to the approach of the end settings of the member, are superfluous. A reliable adjusting of the member within the limits preset by the transmitter system is particularly advantageous, wherein a positioning of the electrical drive in a closed position of the member (zero setting) is possible at any time.

An embodiment of the present invention will now be more particularly described by way of example with reference to the accompanying drawings, in which:

Fig. 1 is a schematic diagram of adjusting means embodying the invention; and

Fig. 2 is a diagram showing cam states (development in circumferential direction) of cams in the adjusting means.

Referring now to the drawings there is shown in Fig. 1 an adjusting device 1, which comprises an electric motor 10 for the drive of a movable part 11, in particular a sliding-raising roof of a motor vehicle. The position of the sliding-raising roof 11 is detected by an incremental position transmitter 15 as well as by two absolute value position transmitters 16 and 17.

The two absolute value position transmitters 16 and 17 are connected with the motor 15 by way of a gear 14. The incremental position transmitter 15 is preferably a magnetic sensor

and, for example, connected directly with the motor 10 at its armature. The transmitter 15 consists of, for example, a Hall switch and a ring magnet provided at the armature of the motor 10 in order to count the armature rotations. An actual position value ascertaining unit 27, which is, for example, a microcontroller, is provided in order to be able to evaluate electrical position signals from pick-ups 19 and 20 co-operating with the transmitter 15. The position signals from the position transmitter 15 are not on their own sufficient for ascertaining the absolute position of the roof 11. The missing information about the absolute position is received by the unit 27 from the two absolute value transmitters 16 and 17. The first transmitter 16 is constructed as, for example, a cam disc 22, with a first cam 23 and a second cam 24. The cams 23 and 24 co-operate with switching means 25 for delivery of an absolute value position signal 26 to the unit 27. In like manner, the second transmitter 17 is, for example, a cam disc 30 with a first cam 31 and a second cam 32. The cams 31 and 32 co-operate with switching means 33 for delivery of a corresponding absolute value position signal 34 to the unit 27. The two switching means 25 and 33 can be, for example, microswitches. A movement across a cam flank of the cam discs 22 and 33, which corresponds with a certain reference position of the roof 11, initiates a switching operation which is detectable by the actual unit 27. During operation, a calibration of the incremental position transmitter 15 or the positional regulation can thus take place for each movement across a cam flank of the cams 23, 24, 31 and 32. The transmitters 16 and 17 supply an unambiguous signal only when the maximum positional travel path of the roof 11 corresponds at most to one rotation of the cam discs 22 and 30. In general, the gear 14 is therefore required for adaptation.

An actual position signal 37 delivered by the unit 27 is compared in a regulator 39 with a target position value signal 41 delivered by a target position value transmitter 40. The regulator 39 delivers a positional regulation signal 42 to setting equipment 43, which produces a setting signal 44 for the motor 10. By means of the incremental position transmitter 15 as well as the two absolute value position transmitters 16 and 17, it is possible to obtain an unambiguous association with the electrical signals delivered by the transmitters 15, 16 and 17 for any desired position of the roof 11 independently of whether a failure of the adjusting device 1 or a manual positional change of the roof has taken place. This makes precise determination of the actual position of the roof 11 possible at any time.

The adjusting device 1 thus comprises an electronic system which secures the opening and closing of the roof 11. For actuation of the motor 10 and drive control of the same, a logic switch and a door-closing contact are provided. Fig. 2 is a diagram showing cam states of the first cam 22, denoted in the following as lifting cam 22, and of the second cam 30, denoted in the following as end cam 30, in dependence on the actual position of the roof 11. The roof 11 can assume four states. The states are: state 0 "sliding", state 1 "raising", state 2 "abutment-sliding" and state 3 "abutment-raising". The three end settings of the roof 11, namely the zero setting (roof closed) indicated in Fig. 2 by "CLOSED", the end setting of the raised position indicated by "OPEN (RAISED)" and the end setting of the sliding position indicated by "OPEN (SLID)", are shown in Fig. 2. When the logic switch of the motor 10 is actuated, the roof 11 moves according to the associated direction up to the respective stop position ascertained by the incremental position transmitter 15 insofar as the logic switch has not been released previously. If the roof 11 is, for example, to be brought out of the slid open position into the raised position, then the logic switch for the raised position must be actuated until the end setting of the raised position is reached. In that case, the electrical motor 10 moves across the zero setting without an intermediate stop. If the logic switch is released before the reaching of the end setting, the motor 10 stops at once. When the logic switch for closing is actuated, the roof 11 moves independently of the respective position into its zero setting insofar as the logic switch has not been released previously.

An automatic operation is also possible. The automatic operation is initiated when the logic switch is actuated for a time of between 50 milliseconds and 0.4 seconds during the opening in the sliding position or in the raising position of the roof 11. From this instant onward, the logic switch, for example a rocker switch, can be released, whereafter the roof 11 moves automatically to the respective end setting. If the logic switch is actuated again after the initiated automatic operation, then the motor 10 is stopped at once. The motor 10 remains at rest thereafter until the logic switch is released again and a renewed actuation takes place.

In the so-called normalised state, in which the incremental position transmitter 15 is calibrated or reset, both manual and automatic operation are possible. The roof 11 is closed when the motor 10 recognises the falling cam flank of the raising cam 22 from raised position into slid position. Coming from the slid position, zero setting is reversed

into, which means reset. It is thereby ensured that the motor 10 is always switched off only at a switching flank.

The advantage of the adjusting means is that, in conjunction with the incremental position transmitter 15, the positions of end of raising and sliding position need no longer be approached by the switching flank E1 and E2 of the position signal 34 of the second absolute value position transmitter 17. These switching flanks E1 and E2 merely serve for fixing a range limit which may not be exceeded in any case. The switching flanks E1 and E2 are also utilised for the preliminary normalising and, optionally also, for the coding of the system. The switching flank H1, H2 of the positional signal 26 of the first transmitter 16 is utilised for the closing of the roof 11 coming from the raised position. Coming from the slid position, the closed position is determined by means of the incremental position transmitter 15 in that the overrun value of the motor 10 is utilised for positioning. For tolerance reasons, the association of the cams 22 and 30 with each other is critical. Due to the use of two absolute value position transmitters 16 and 17, which represent limit switches and are used only for regional monitoring, an enlarged tolerance range is possible. The end angles for the precise drive control of the electrical motor 10 are then, in the case of the normalised system, determined only by the incremental position transmitter 15. The closed position of the roof 11 is moreover determined by the switching flanks H1 and H2 only coming from the raised position. Coming from the slid position, the zero setting is no longer approached by reversing at the switching flank, but approached through the incremental transmitter 15 with inclusion of the last motor overrun.

Normalisation of the incremental transmitter 15 takes place in the case of a new start or failure of the system in the manner that the logic switch is actuated continuously for actuation of the motor 10, and the motor in manual operation recognises a switching flank, which is associated with the respective direction of rotation, of the microswitch system 25, 33. If the motor is not normalised, automatic operation is blocked and the motor is operated at low speed.

In the undefined, i.e. end-normalised state (after a voltage failure or reset), the roof 11 can be disposed in different states. The following reactions are possible in that case. In the first state "0", clockwise and anticlockwise running of the motor 10 is possible. In the case of anticlockwise running, the system is normalised at the switching flank H1, for which the target position "CLOSED" is reversed appropriately. For clockwise running, thereagainst,

a stop is effected on reaching the switching flank E4. In the second state "1", clockwise and also anticlockwise running of the motor 10 are permitted. For clockwise running, the system can be normalised appropriately at the switching flank H2. For anticlockwise running, thereagainst, a stop takes place on reaching the switching flank E2. In the third state "2", clockwise running is not permitted, so that the system is preliminarily normalised at E3 for anticlockwise running. A final normalising takes place thereafter at the switching position H1. A clockwise running is possible thereafter only when the actual position lies in the normal range (first state "0" and second state "1"). In the fourth state "3", anticlockwise running is not permitted, which means that the system is normalised preliminarily at the switching flank A3 during clockwise running of the motor and finally normalised at the switching flank H2. Anticlockwise running is possible thereafter only when the actual position lies in the normal range (first state "0" and second state "1"). The normalised system can be disposed only in the first state "0" and in the second state "1". Here, the adjustment is possible in the normal range for raising and sliding. When the third state "2" or the fourth state "3" is reached in the normal state, the motor 10 is stopped at once and the system is denormalised. The first, second, third and fourth states are identified in Fig. 2 by "0", "1", "2" and "3", respectively.

All positionings of the motor 10, even the end setting of the raised position and the slid position of the roof 11, are effected by means of the incremental position transmitter 15. Only the zero setting is always referred to the falling switching flank at the zero cam (raising cam 32). The position transmitter 15 is initialised again in zero setting for each flank change. If the system was denormalised previously, then the switching flanks E1 or E3 are utilised for preliminary normalising. The final normalising then takes place at the switching point H1 and H2. The switching point H1 is the reference for the raising angle and H2 for the sliding angle. The zero position is situated at the transition of the raising cam 22 from the raised position into the slid position. In order to exclude the influence of hysteresis at the raising cam 22, starting of the motor 10 always takes place out of the raised region into the zero position.

CLAIMS

1. Adjusting means for a movable member, comprising drive means for driving the member between a plurality of defined positions, an incremental position transmitter for providing a signal indicative of incremental positioning of the member, two absolute value position transmitters for providing signals indicative of absolute positions of the member, each absolute value position transmitter being operable to deliver a respective signal in each of two switching states thereof, and determining means for determining the position of the member from the transmitter signals.

2. Adjusting means as claimed in claim 1, the determining means being operable to determine the position of the member in dependence on the direction of rotation of a rotary element of the drive means from changes in switching state of the absolute value position transmitters.

3. Adjusting means as claimed in claim 1 or claim 2, wherein each absolute value position transmitter (16, 17) comprises at least two cams and respective switching means operable by the cams.

4. Adjusting means as claimed in claim 3, the switching means comprising microswitches.

5. Adjusting means as claimed in any one of the preceding claims, wherein one of the defined positions of the member is a closed position closing an aperture and the determining means is operable to determine the closed position of the member from the flank of a signal of one of the absolute value position transmitters.

6. Adjusting means as claimed in any one of the preceding claims, the determining means comprising a microcontroller.

7. Adjusting means as claimed in any one of the preceding claims, wherein the member is a motor vehicle roof panel movable between a closed position, a pivoted open position and a slid open position.

8. Adjusting means substantially as hereinbefore described with reference to the accompanying drawings.

9. A motor vehicle provided with adjusting means as claimed in claim 7.

The Patent Office

Application No:	GB 9726399.0	**Examiner:**	David Mobbs
Claims searched:	1-9	**Date of search:**	9 March 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): G3N NGA4, NGCA, NGCA4, NGCA4A, NGCA5.

Int Cl (Ed.6): B60J 7/057; E05F 15/00, 15/14, 15/16; G05B 19/39; G05D 3/20.

Other: ONLINE: WPI.

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2,118,739 A	(Somfy) - see particularly figure 4. Tracks of discs 22, 23 give signals in two switching states.	1, 6.
X, P	WO 97/14512 A	(Webasto Sunroofs) - see pages 10-12.	1, 6.
X	EP 0,544,135 A	(Gretsch-Unitas GmbH) - see devices 10, 11 on the figure and column 3.	1, 6.

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
		E	Patent document published on or after, but with priority date earlier than, the filing date of this application.
&	Member of the same patent family		